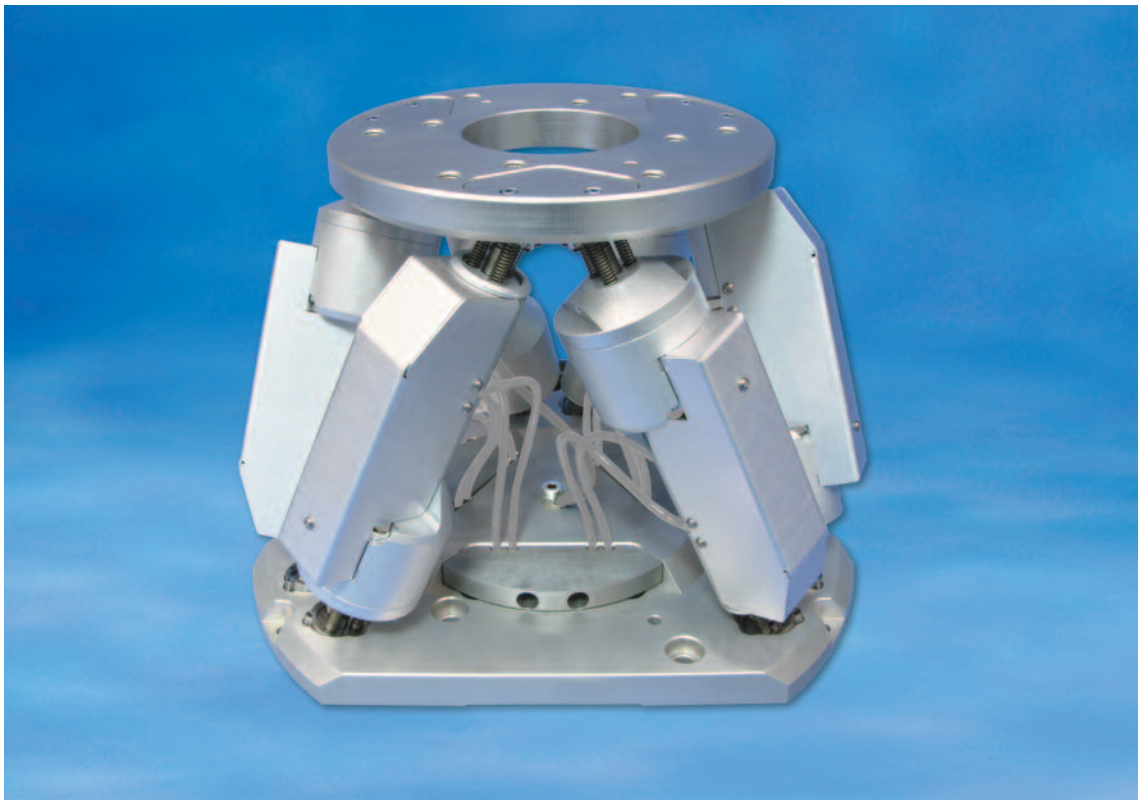
HXP50-MECAV6 Hexapod

Vacuum Compatible 6-Axis-Parallel Kinematic Positioning System



RoHS Compliant

Newport®
Experience | Solutions

USER'S MANUAL

Precision Motion – *Guaranteed*™

Warranty

Newport Corporation warrants this product to be free from defects in material and workmanship for a period of 1 year from the date of shipment. If found to be defective during the warranty period, the product will either be repaired or replaced at Newport's discretion.

To exercise this warranty, write or call your local Newport representative, or contact Newport headquarters in Irvine, California. You will be given prompt assistance and return instructions. Send the instrument, transportation prepaid, to the indicated service facility. Repairs will be made and the instrument returned, transportation prepaid. Repaired products are warranted for the balance of the original warranty period, or at least 90 days.

Limitation of Warranty

This warranty does not apply to defects resulting from modification or misuse of any product or part.

CAUTION

Warranty does not apply to damages resulting from:

- **Incorrect usage:**
  - **Load on the Hexapod greater than maximum specified load.**
  - **Carriage speed higher than specified speed.**
  - **Improper grounding.**
    - ¬ **Connectors must be properly secured.**
    - ¬ **When the load on the Hexapod represents an electrical risk, it must be connected to ground.**
  - **Excessive or improper cantilever loads.**
- **Modification of the Hexapod or any part thereof.**

CAUTION

Please return equipment in the original (or equivalent) packing.

You will be responsible for damage incurred from inadequate packaging if the original packaging is not used.

This warranty is in lieu of all other warranties, expressed or implied, including any implied warranty of merchantability or fitness for a particular use. Newport Corporation shall not be liable for any indirect, special, or consequential damages.

No part of this manual may be reproduced or copied without the prior written approval of Newport Corporation.

This manual has been provided for information only and product specifications are subject to change without notice. Any changes will be reflected in future printings.

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EC Declaration of Conformity

HXP50-MECA Series

Newport
Experience | Solutions

EC Declaration of Conformity

following Annex II-1A
of Directive 2006/42/EC on machinery

The manufacturer:

MICRO-CONTROLE Spectra-Physics,
9, rue du Bois Sauvage
91055 Evry CEDEX, FRANCE

Hereby declares that the machinery:

- Description: " HXP50-MECA "
- Function: 6-Axis Kinematic Positioning System
- Models: HXP50-MECA ; HXP50-MECAV6

– the technical file of which was compiled by:

Mr Dominique DEVIDAL, Quality Director,
MICRO-CONTROLE Spectra-Physics, Zone Industrielle - B.P.29
F-45340 Beaune La Rolande France

– complies with all the relevant provisions of the Directive 2006/42/EC on machinery.
– complies with all the relevant provisions of the Directive 2004/108/EC relating to electro-magnetic compatibility.

– was designed and built in accordance with the following harmonised standards:

- NF EN 61326-1:2006 « Electrical equipment for measurement, control and laboratory use – EMC requirements – Part 1: General requirements »
- NF EN 55011:2007 Class A

– was designed and built in accordance with the following other standards:

- NF EN 61000-4-2
- NF EN 61000-4-3
- NF EN 61000-4-4
- NF EN 61000-4-5
- NF EN 61000-4-6

ORIGINAL DECLARATION

Done in Beaune La Rolande on 25 February 2013
Dominique DEVIDAL
Quality Director

DC1-EN rev:A

Definitions and Symbols

The following terms and symbols are used in this documentation and also appear on the product where safety-related issues occur.

General Warning or Caution

The exclamation symbol may appear in warning and caution tables in this document. This symbol designates an area where personal injury or damage to the equipment is possible.

The following are definitions of the Warnings, Cautions and Notes that may be used in this manual to call attention to important information regarding personal safety, safety and preservation of the equipment, or important tips.

WARNING

Warning indicates a potentially dangerous situation which can result in bodily harm or death.

CAUTION

Caution indicates a potentially hazardous situation which can result in damage to product or equipment.

NOTE

Note indicates additional information that must be considered by the user or operator.

European Union CE Mark

The presence of the CE Mark on Newport Corporation equipment means that it has been designed, tested and certified as complying with all applicable European Union (CE) regulations and recommendations.

Warnings and Cautions

ATTENTION

This stage is a Class A device. In a residential environment, this device can cause electromagnetic interference. In this case, suitable measures must be taken by the user.

Warnings

WARNING

The motion of objects of all types presents potential risks for operators. Protect the operators by prohibiting access to the pinch points marked by the icon on the left. Supplement this with personnel training of the potential risks involved.

WARNING

Stop using the Hexapod when an abnormal condition occurs. Turn off the controller immediately and unplug the power when safe. Abnormal conditions are when an actuator is hot to the touch, an actuator is visibly locked or when an actuator emits an unusual odor or smoke.

Contact your Newport service person for guidance and request repairs. Never attempt to repair the Hexapod yourself as this can be dangerous.

WARNING

Do not expose the Hexapod to moisture and avoid fluids spilling onto the Hexapod. If spills occur, turn the controller off immediately and unplug the power when safe.

Contact your Newport service person for guidance and request repairs. Never attempt to repair the Hexapod yourself as this can be dangerous.

WARNING

Do not insert objects into the Hexapod, as this may lock the drive or eventually cause an electric shock.

Do not use the Hexapod if any foreign objects are found within the Hexapod.

Switch off the controller and then disconnect the HXP controller from the power supply when safe.

Contact your Newport service person for guidance and request repairs. Never attempt to repair the Hexapod yourself as this can be dangerous.

WARNING

Do not place this Hexapod in unstable surfaces like wobbly tables or sloped surfaces, where there is risk of falling or tipping over which could cause injury.

If this Hexapod has been dropped or is suspected of being damaged, switch off the controller and then disconnect the HXP controller from the power supply.

Contact your Newport service person for guidance and request repairs. Never attempt to repair the Hexapod yourself as this can be dangerous.

WARNING

Do not modify this Hexapod; this may cause an electric shock or downgrade its performance. Any modification of this Hexapod will void the warranty.

WARNING

Do not exceed the usable depth indicated for the mounting holes (see section “Dimensions”). Longer screws can damage the mechanics or cause a short-circuit.

Cautions

CAUTION

Do not place this Hexapod in a hostile environment such as X-Rays or UV. Improper use of this Hexapod may cause damage and voids the warranty.

CAUTION

Do not use the top plate or struts for handling. This may cause it to malfunction.

CAUTION

Do not manipulate or turn struts. This may cause it to malfunction.

CAUTION

The locking system must be set up on the hexapod before handling. Use handles for transportation.

CAUTION

Do not place this Hexapod in a location with dust, oil fumes or steam. This may cause an electric shock.

CAUTION

Do not leave this Hexapod in places subject to extremely high temperatures or low temperatures. This may cause an electric shock.

- **Operating temperature: +10 to +35 °C.**
- **Storage temperature: -10 to +40 °C (in its original packaging).**

CAUTION

Do not move this Hexapod if power is on.

Make sure that cables to the HXP controller are disconnected before moving the Hexapod. Failure to do so may damage cables and cause an electrical shock.

CAUTION

Be careful that the Hexapod is not bumped when it is being carried. This may cause it to malfunction.

CAUTION

Before handling this Hexapod, always unplug the equipment from the power source for safety.

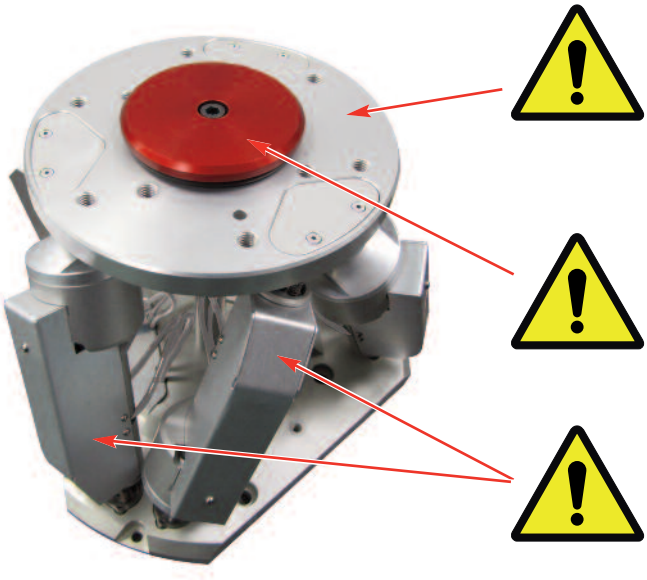
CAUTION

Contact your Newport service facility to request cleaning and testing every year.

Vacuum Compatible 6-Axis-Parallel Kinematic Positioning System HXP50-MECAV6 Hexapod

1.0 Introduction

This manual provides operating instructions for the hexapod HXP50-MECAV6.



CAUTION

Do not use the top plate or struts for handling.

CAUTION

Remove the locking system before using.

CAUTION

Do not manually turn struts.

CAUTION

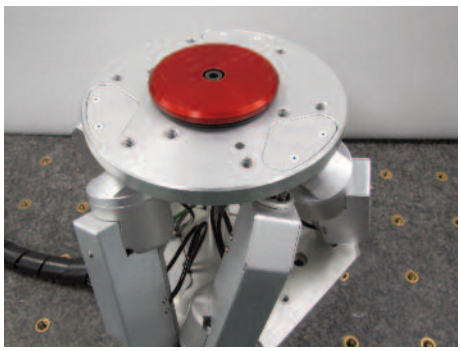
Please read all chapters of this manual carefully before operating your Hexapod.

NOTE

This product complies with the RoHS directive (Restriction of Hazardous Substances).

1.1 Remove the Locking System

Hexapod ball studs can be damaged if they are subject to pulling. This can happen while handling or transportation of the HXP50.

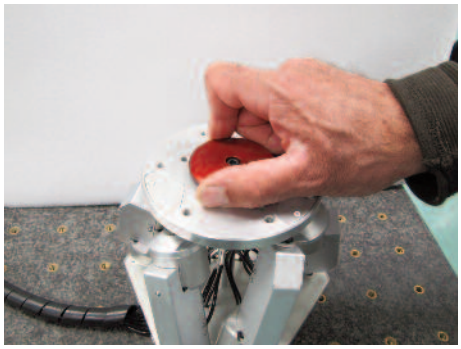


To avoid damages, the HXP50-MECAV6 is delivered with a locking system that includes a center rod and a clamping wheel.

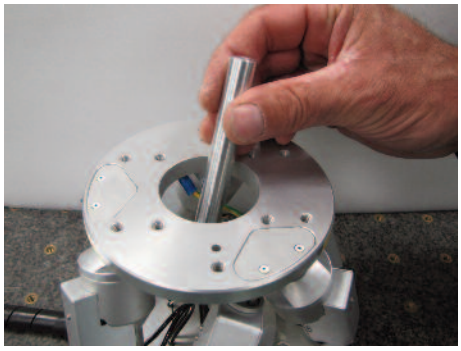
CAUTION

Remove the locking system before operating the HXP50-MECAV6 Hexapod.

❶ Remove the clamping wheel.



❷ Remove the center rod.



NOTE

Pictures shown are for the standard HXP50-MECA, please use proper precautions when handling the vacuum compatible unit.

2.0 Description

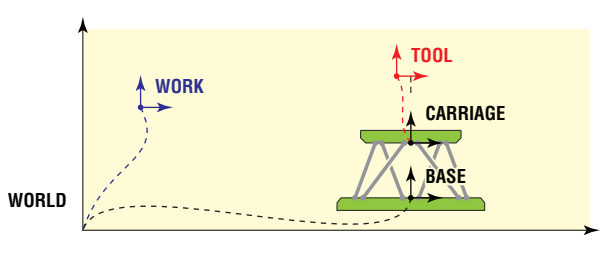
The HXP50-MECAV6 hexapod is a parallel kinematic motion device that provides six degrees of freedom: X, Y, Z, pitch, roll, and yaw. Hexapods are well known as effective solutions for complex motion applications that demand high load capacity and precision in up to six independent axes. Yet, they still have the image of being complex and highly priced. With the HXP50-MECAV6, Newport continues to introduce Hexapods that are not only affordable but also extremely easy to use.

The HXP50-MECAV6 is driven by six stepper motor driven actuators with encoder feedback, encoder on the motor, providing precise MIM, low backlash and fast speed. The HXP50-MECAV6 can be run in open loop or closed loop, allowing the choice of different levels of performance like MIM and repeatability. The quality of the actuators has obviously a strong impact on the overall motion performance of the HXP50-MECAV6, but of equal importance are the joints with which the actuators are attached to the base and the moving top plate. With size and rigidity in mind, our engineers came up with innovative spherical joints that are not only very simple, but also enhance the stiffness of the hexapod.

The HXP50-ELEC controller accurately masters the synchronized transformations from Cartesian input coordinates to the motion of the Hexapod legs. In addition, the HXP50-ELEC provides advanced features including instrument grade I/O's, hardware based input triggers, event triggers, high-speed on-the-fly data acquisition, fast TCP/IP communication, and integrated TCL programming language for on-board processes. All these features improve accuracy and throughput, making the programmer's life much easier.

Two main advantages of the HXP50-MECAV6, as with the other Newport hexapods, are the ability to program two pivot points represented by the Tool and Work coordinate systems, and RightPath™ Trajectory Control. The Tool CS moves with the top plate and the Work is stationary. Imagine a machine tool where one can adjust the orientation of both the cutting tool and workpiece or in photonics, the optical beam and the sample. Incremental displacements are possible in either system in user-friendly Cartesian coordinates, and positions can be easily switched from one system to the other by a function call or by numerical input in the HXP's web site interface. RightPath™ Trajectory Control enables scanning in a path along a defined trajecotry, line, arc or rotation, with minimal runout and at a constant and definable speed enabling smooth well defined motion. These powerful functions are a completely new way of mastering Hexapod motions without the need for complex external coordinate transformations.

As a standard feature, the HXP50-ELEC controller allows the user to choose a virtual pivot point in space for all rotations.



Absolute moves and positions are defined in the work coordinate system. Incremental moves can be done in the tool or in the work coordinate systems.

3.0 Characteristics

3.1 Mechanical Specifications

	X	Y	Z	θx	θy	θz
Travel range [1]	±17 mm	±15 mm	±7 mm	±9°	±8.5°	±18°
MIM, Minimum incremental motion [4]	0.2 µm/0.8 µm	0.2 µm/0.8 µm	0.1 µm/0.4 µm	0.1 mdeg/0.4 mdeg	0.1 mdeg/0.4 mdeg	0.2 mdeg/0.8 mdeg
Uni-directional repeatability, typical	0.4 µm	0.4 µm	0.2 µm	0.2 mdeg	0.2 mdeg	0.4 mdeg
Bi-directional repeatability, typical [2]	2 µm	2 µm	1 µm	1 mdeg	1 mdeg	2 mdeg
Max. speed	2 mm/s	1.8 mm/s	0.8 mm/s	0.9 °/s	0.9 °/s	2 °/s
Stiffness [3]	2 N/µm	2 N/µm	25 N/µm	–	–	–

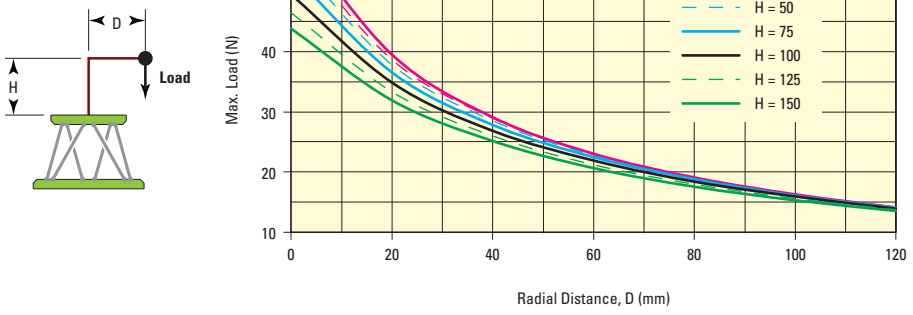
1) Travel ranges are interdependent. The listed values are max. travels per axis when all other axis are in their centered position (Height = 151 mm for Z).
2) With standard setting.
3) Stiffness depends on Hexapod position. Values are given for all axis in their centered position.
4) Open loop/Closed loop.

CAUTION

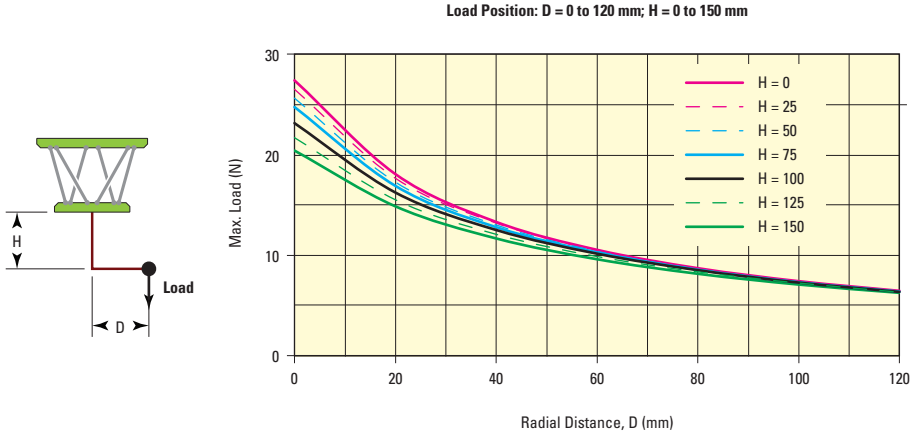
To reach the specifications stated, stages must be fixed on a plane surface with a flatness of 50 µm or better.

3.2 Max. Cantilever Distance of the Load

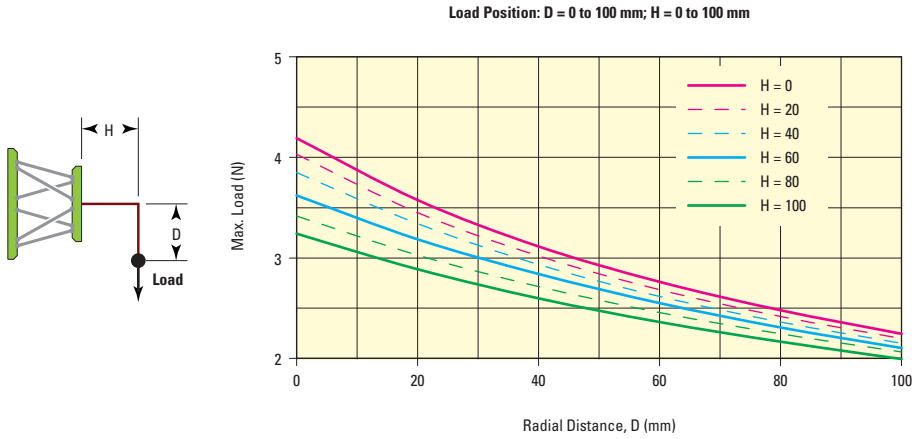
3.2.1 Horizontal Base Plate



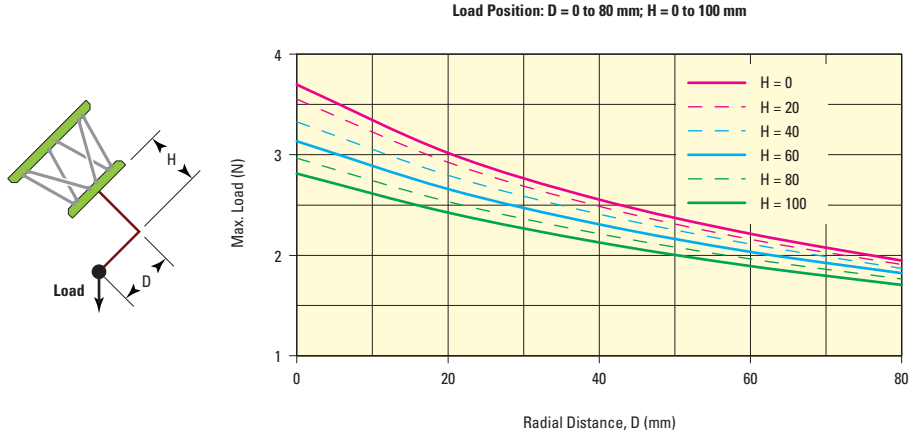
3.2.2 Base Plate Upside-Down



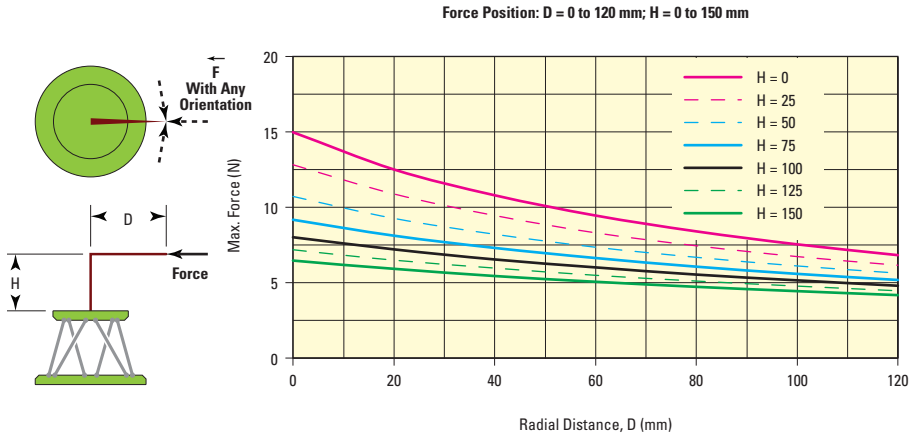
3.2.3 Vertical Base Plate



3.2.4 Base Plate at Any Position



3.2.5 Horizontal Base Plate - Lateral Force



3.3 Weight

	Weight [lb (kg)]
Hexapod (without cables)	3.8 (1.7)
Cables	2.2 (1.0)

4.0 Connection to the HXP50-ELEC Controller

4.1 Warnings on Controllers

Controllers are intended for use by qualified personnel who recognize shock hazards and are familiar with safety precautions required to avoid possible injury. Read the controller user's manual carefully before operating the instrument and pay attention to all written warnings and cautions.

WARNING

Disconnect the power plug under the following circumstances:

- **If the power cord or any attached cables are frayed or damaged in any way.**
- **If the power plug is damaged in any way.**
- **If the unit is exposed to rain, excessive moisture, or liquids are spilled on the unit.**
- **If the unit has been dropped or the case is damaged.**
- **If you suspect service or repair is required.**
- **Whenever you clean the electronics unit.**

CAUTION

To protect the unit from damage, be sure to:

- **Keep all air vents free of dirt and dust.**
- **Keep all liquids away from the unit.**
- **Do not expose the unit to excessive moisture (85% humidity).**
- **Read this manual and the HXP controller manual before using the Hexapod for the first time.**

WARNING

All attachment plug receptacles in the vicinity of this unit are to be of the grounding type and properly polarized.

Contact an electrician to check your receptacles.

WARNING

This product is equipped with a 3-wire grounding type plug.

Any interruption of the grounding connection can create an electric shock hazard.

If you are unable to insert the plug into the wall plug receptacle, contact an electrician to perform the necessary alterations to ensure that the green (green-yellow) wire is connected to earth ground.

WARNING

This product operates with voltages that can be lethal.

Pushing objects of any kind into cabinet slots or holes, or spilling any liquid on the product, may cause electrical shorts.

4.2 Connection

WARNING

Always turn the controller's power OFF before connecting or disconnecting a strut.

Anytime prior to power-up, each strut must be connected with the supplied cable to the corresponding Sub-D25 plug located at the rear panel of the HXP50-ELEC controller, labeled “MOTOR”.

6 SUB-D25 CONNECTORS FOR MOTOR CABLES

WARNING

Each Hexapod strut corresponds to the axis number of the HXP50-ELEC controller. This label is indicated on the Sub-D25 connector of the strut.

4.3 Cables

Each Hexapod is equipped with cables terminated with 25-pin Sub-D connectors. These cables are directly connected to the HXP50-ELEC.

There are 6 cables total to connect to the corresponding plugs on the controller.

CAUTION

Numbering of axes is important for both motor connections. A mismatch will cause fatal errors during initialization.

WARNING

These cables are shielded properly. For correct operation, make sure to lock the connectors (ground continuity provided by the cable).

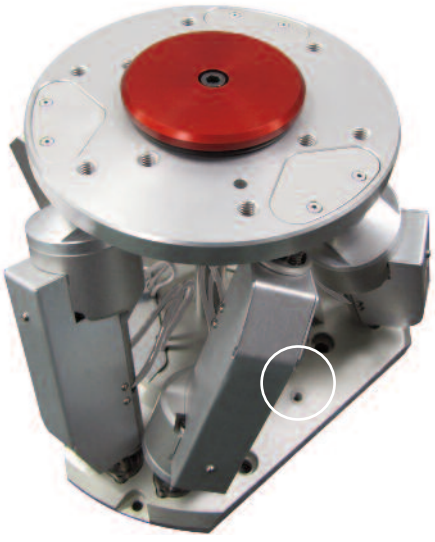
WARNING

Keep the motor cables at a safe distance from other electrical cables in the vicinity to avoid potential cross talk.

NOTE

On each connector, a sticker indicates the home preset and backlash on the Sub-D25 connector.

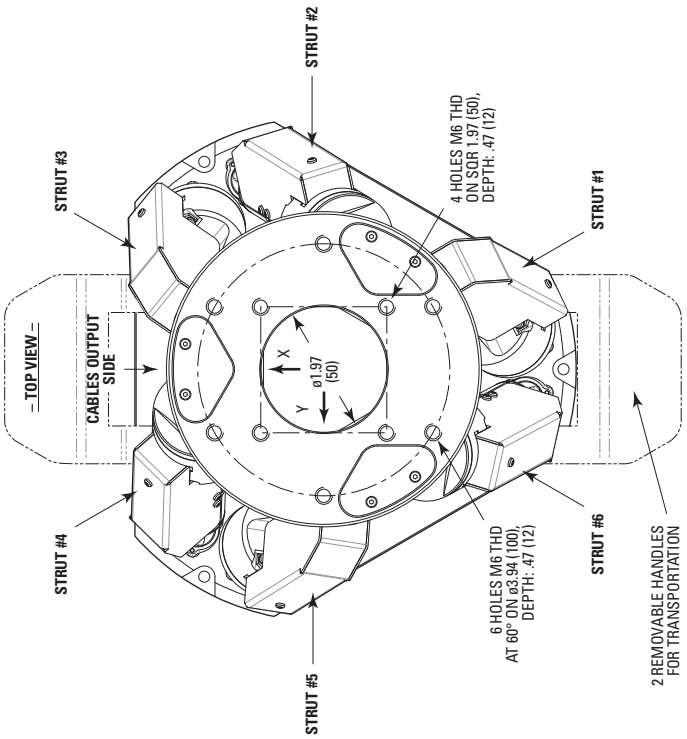
These parameters have to be set into the HXP50-ELEC controller for each strut. This is done at our factory when the HXP50-MECAV6 Hexapod is ordered with the HXP50-ELEC controller.

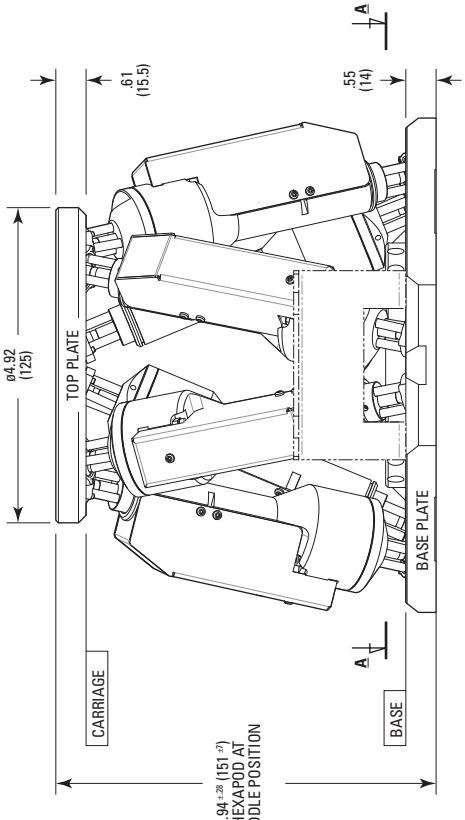


WARNING

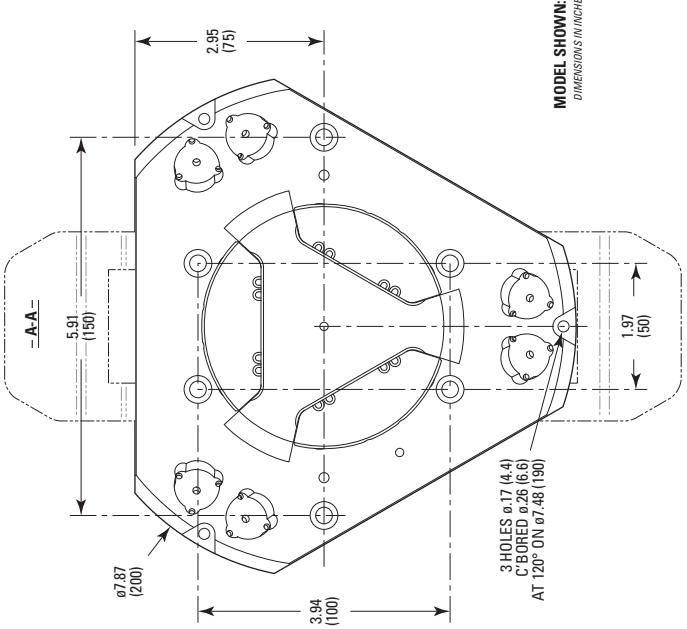
The HXP50-MECAV6, via a threaded hole, must be grounded to avoid electrical disturbances generated by ground loops.

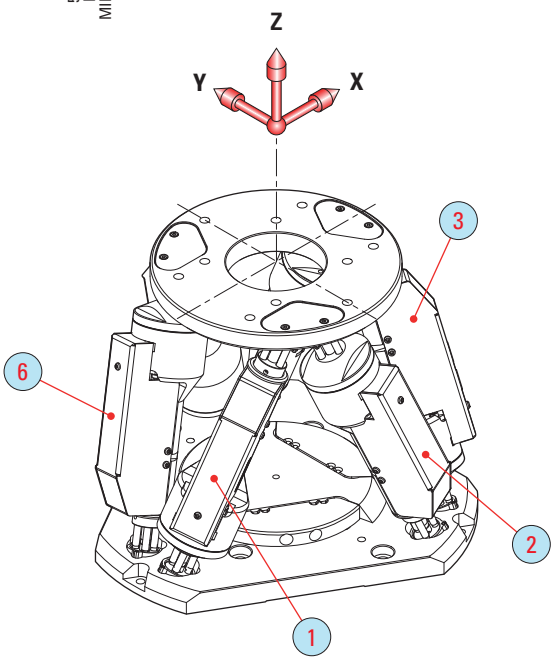
5.0 Dimensions





MODEL SHOWN: HXP50-MECAV6
DIMENSIONS IN INCHES (AND MILLIMETERS)





NOTE
The +X-axis points in the direction of the cable output between struts #3 and #4.

NOTE

Top and base plates of the HXP50-MECAV6 Hexapod are made of aluminum.

6.0 Maintenance

6.1 Maintenance

The Hexapod requires no particular maintenance. Nevertheless, like any precision mechanical device it must be treated and handled with care.

PRECAUTIONS

The Hexapod must be operated and stored in a clean environment, without dust, excessive humidity, solvents or other substances.

RECOMMENDATION

It is recommended to return your Hexapod to our After Sales Service after every 2000 hours of use for maintenance.

If your Hexapod is mounted on a workstation and cannot be easily handled, please contact our After Sales Service for further instructions.

6.2 Repairing

CAUTION

Never attempt to disassemble an element of the Hexapod that has not been specified in this manual.

To disassemble a non specified element can cause a malfunction of the Hexapod.

If you observe a malfunction in your Hexapod, please contact Newport immediately to arrange for a repair.

CAUTION

Any disassembly or attempts to repair the Hexapod without proper authorization will void your warranty.

Service Form

Your Local Representative
Tel.: _____
Fax: _____

Name: _____ Return authorization #: _____
(Please obtain prior to return of item)

Company: _____

Address: _____ Date: _____

Country: _____ Phone Number: _____

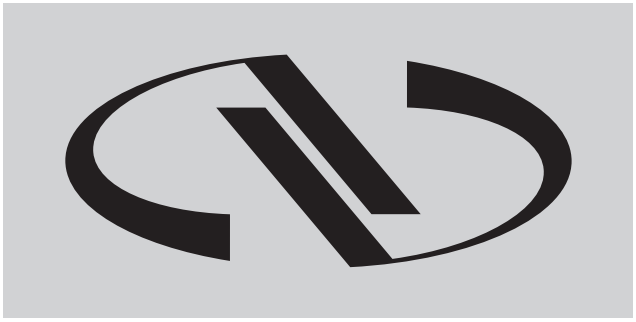
P.O. Number: _____ Fax Number: _____

Item(s) Being Returned:

Model #: _____ Serial #: _____

Description: _____

Reasons of return of goods (please list any specific problems): _____



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